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(54) **SNOUT HEIGHT AND TENSION
ADJUSTMENT**

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A01D 41/06 (2006.01)
A01D 45/02 (2006.01)

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CPC **A01D 41/06** (2013.01); **A01D 45/021**
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A10D 41/142; B25B 29/02

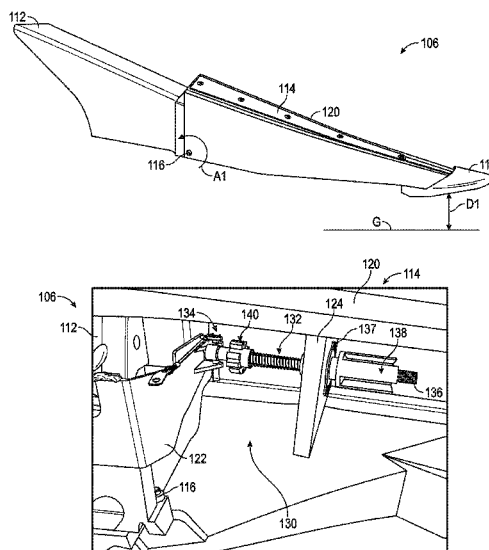
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(57) **ABSTRACT**

Adjustment of snout height and tension is provided for a combine harvester. The combine harvester includes a header having a plurality of row unit divider assemblies. The row unit divider assemblies include a bonnet portion, a snout portion, and a height and tension adjustment device. The height and tension adjustment device is coupled between the bonnet portion and the snout portion and is operable to adjust an angle and tension of the snout portion with respect to the bonnet portion.

14 Claims, 5 Drawing Sheets



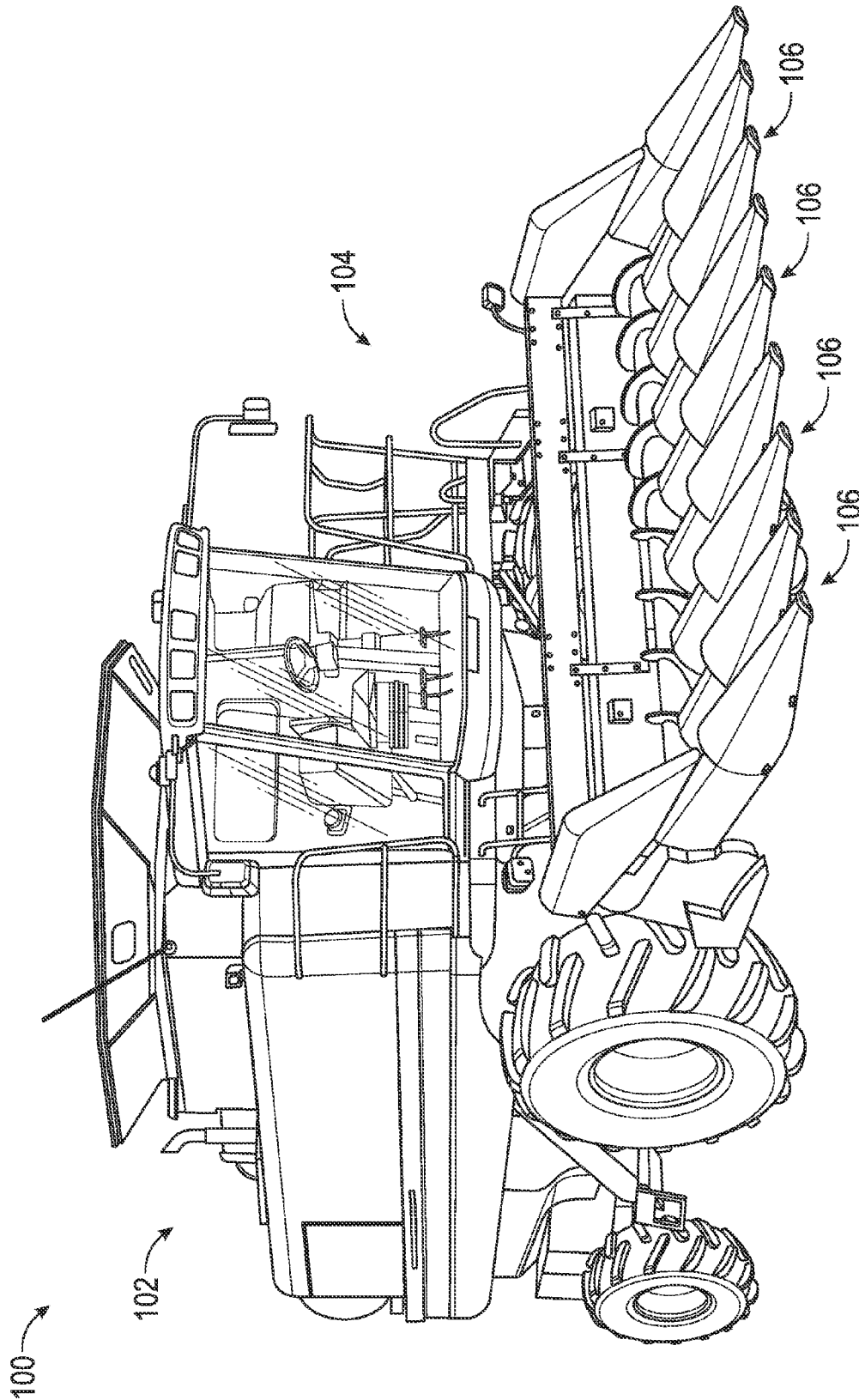


FIG. 1

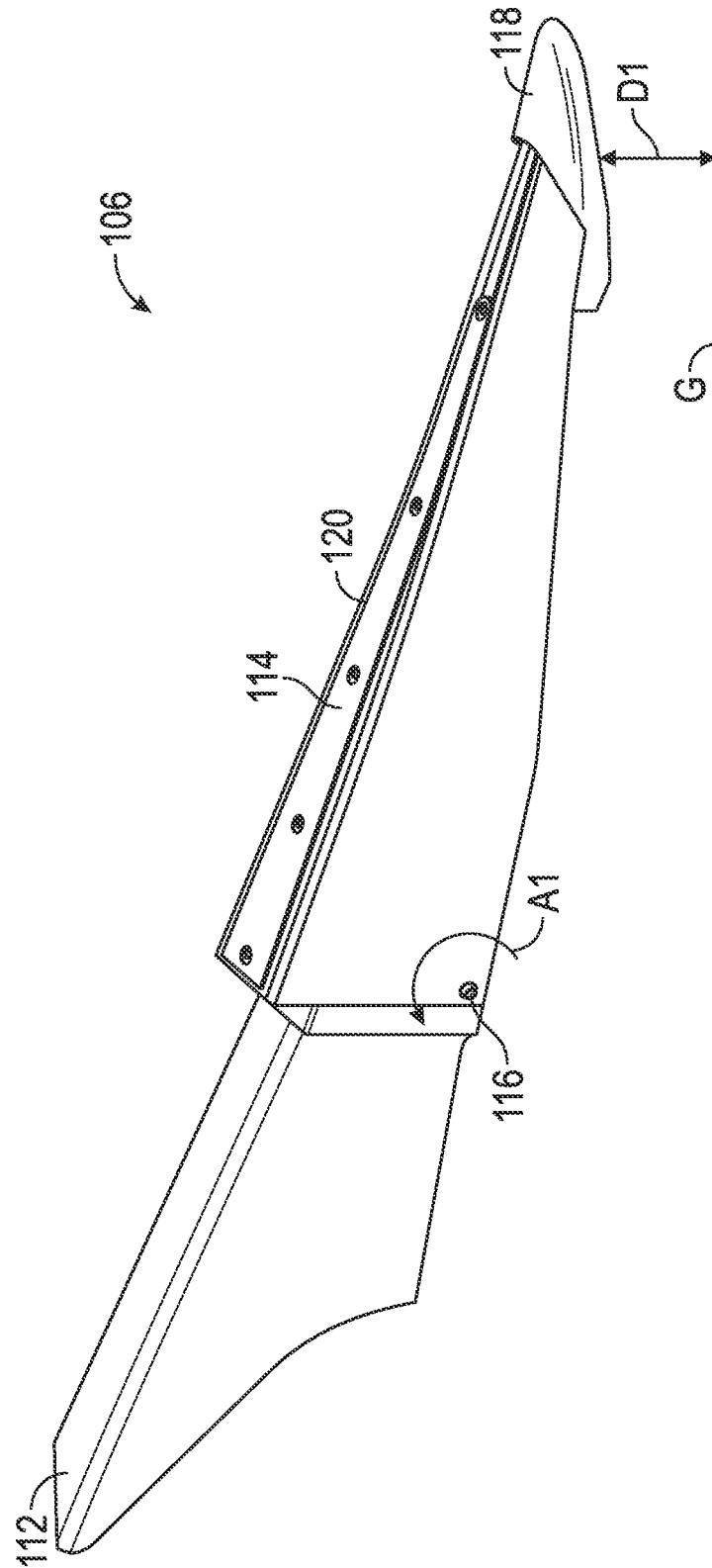


FIG. 2

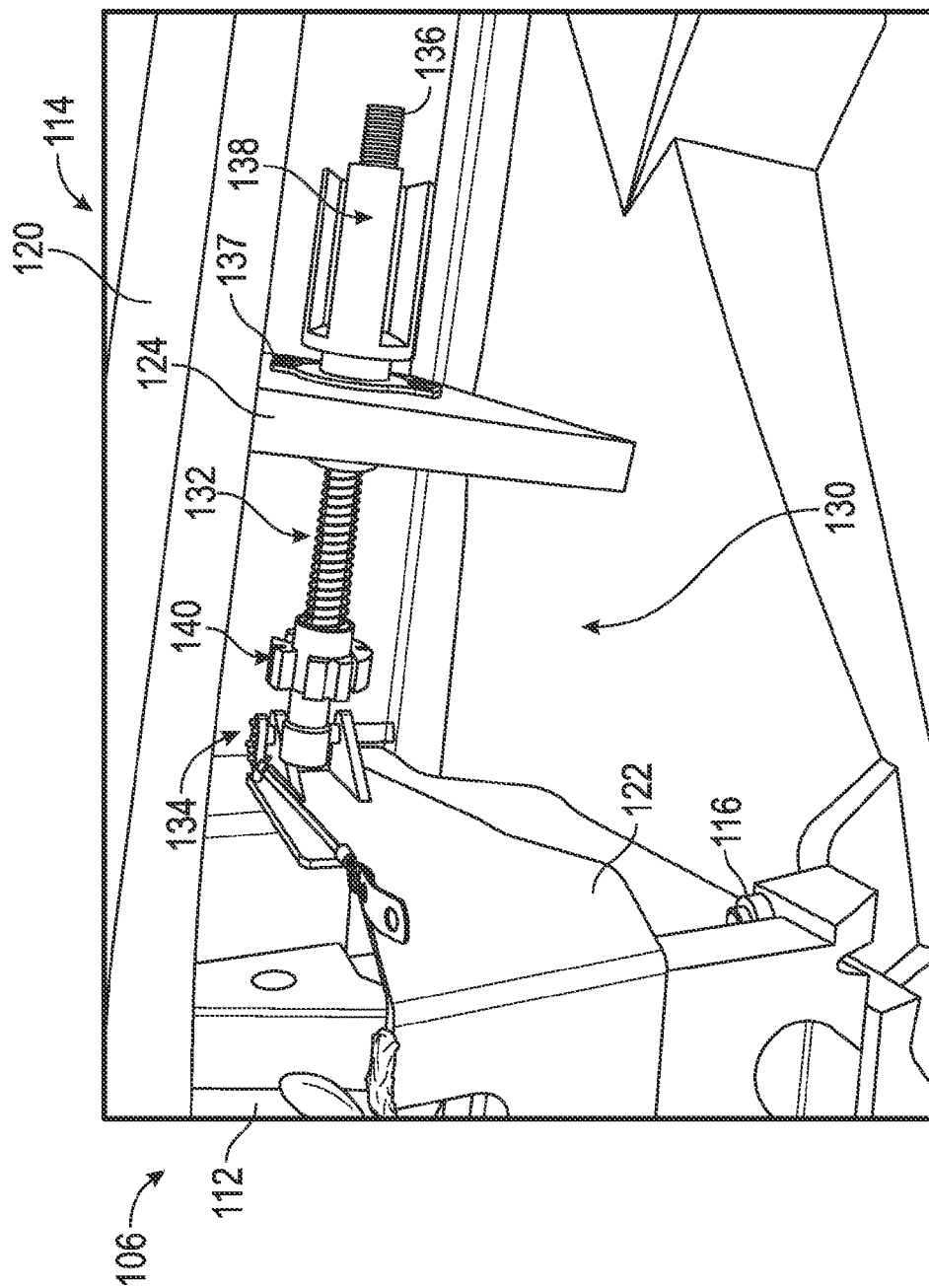


FIG. 3

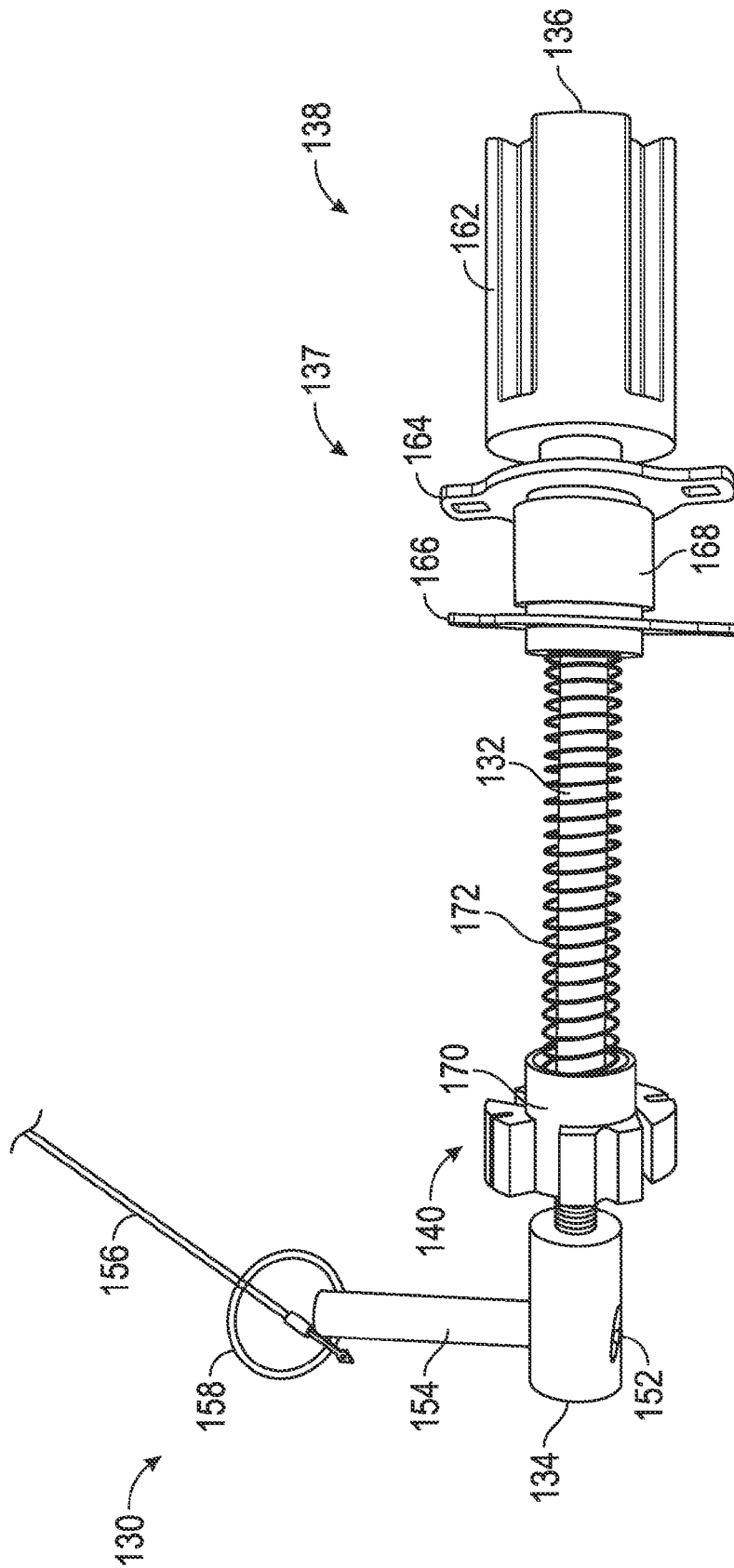


FIG. 4

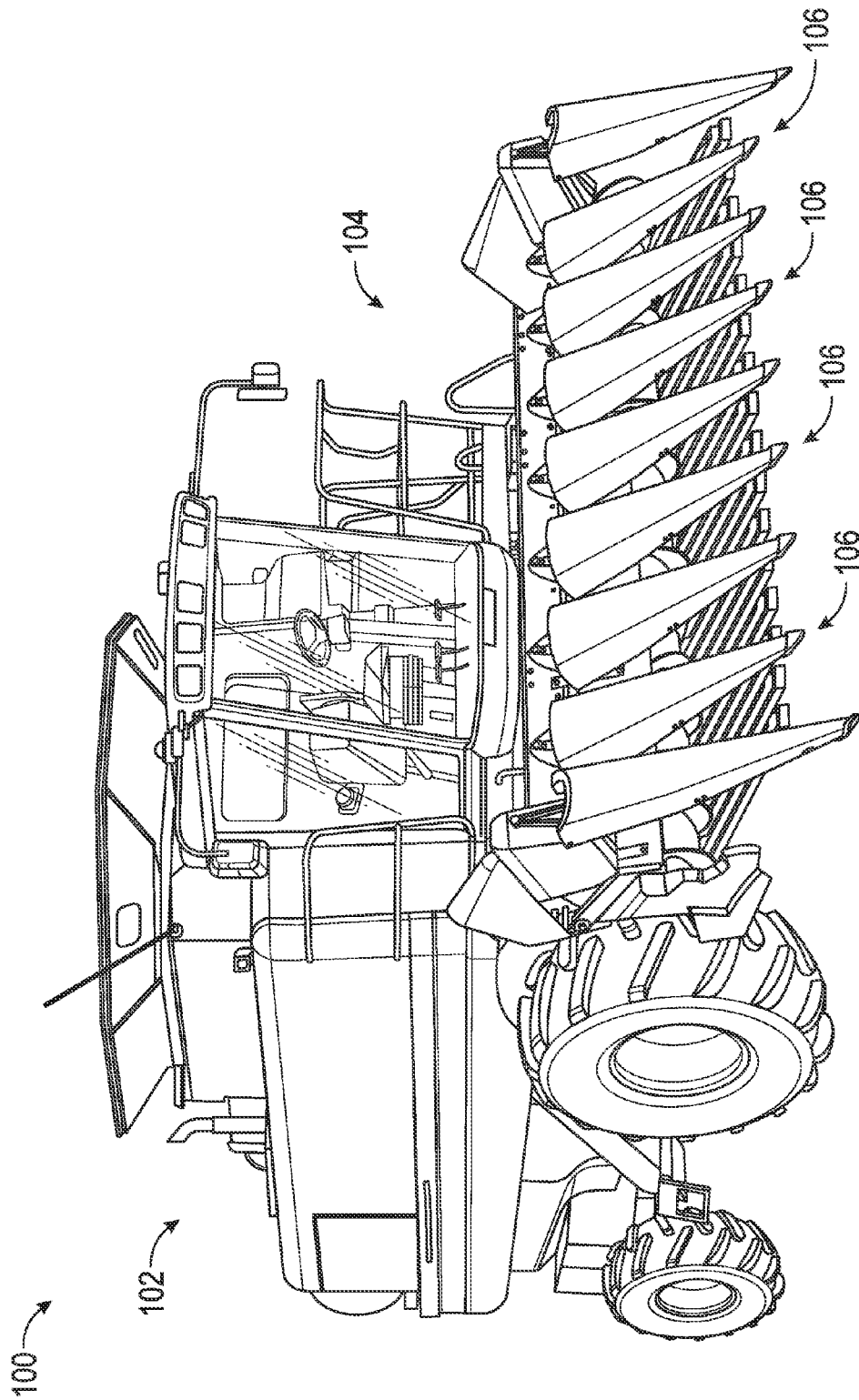


FIG. 5

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SNOUT HEIGHT AND TENSION ADJUSTMENT

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to U.S. Application No. 61/725,452, titled SNOUT HEIGHT AND TENSION ADJUSTMENT, filed on Nov. 12, 2012, the disclosure of which is hereby incorporated by reference in its entirety.

BACKGROUND

Harvesting of agricultural crops is often performed using a combine harvester. The combine harvester typically includes a tractor and a header. The header extends out from the front of the tractor and operates to harvest the crops as it is advanced by the tractor through an agricultural field.

SUMMARY

In general terms, the present disclosure relates to a combine harvester, and also relates to height and tension adjustment of a snout of a combine harvester.

One aspect is a row unit divider assembly for a combine harvester, the row unit divider assembly comprising: a bonnet portion; a snout portion pivotally connected to the bonnet portion; and a height and tension adjustment device coupled between the bonnet portion and the snout portion and operable to adjust an angle of the snout portion with respect to the bonnet portion and a tension applied to the snout portion.

Another aspect is a combine harvester including a row unit divider assembly for a combine harvester, the row unit divider assembly comprising: a bonnet portion; a snout portion pivotally connected to the bonnet portion; and a height and tension adjustment device coupled between the bonnet portion and the snout portion and operable to adjust an angle of the snout portion with respect to the bonnet portion and a tension applied to the snout portion.

Yet another aspect is a height and tension adjustment device configured for installation between a bonnet portion of a row unit divider assembly and a snout portion of the row unit divider assembly, the height and tension adjustment device comprising: a rod including a first end and a second end, wherein the first end is configured to be coupled to the bonnet portion of the row unit divider assembly; a height adjustment device positioned toward the second end of the rod and being adjustable along the length of the rod to adjust an angle of the snout portion with respect to the bonnet portion; and a tension adjustment device positioned between the first end of the rod and the height adjustment knob, the tension adjustment knob adjustable along the length of the rod to adjust a force applied to the snout.

A further aspect is a method of adjusting a snout of a row unit divider assembly for a combine harvester, the method comprising: installing a height and tension adjustment device between a bonnet and snout of the row unit divider assembly; adjusting a height of the snout with respect to the ground by adjusting a height adjustment knob of the height and tension adjustment assembly; adjusting a downward force applied to the snout by adjusting a tension adjustment knob of the height and tension adjustment assembly; and resisting upward movement of the snout with respect to the bonnet after adjusting the height and downward force, while permitting upward movement if the upward movement has a sufficient force that exceeds the downward force.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective front view of an example combine harvester according to the present disclosure.

FIG. 2 is a perspective side view of an example row unit divider assembly of the example combine harvester shown in FIG. 1.

FIG. 3 is a perspective bottom view of a portion of the row unit divider assembly shown in FIG. 2, further including a height and tension adjustment device.

FIG. 4 is a side view of the example height and tension adjustment device shown in FIG. 3.

FIG. 5 is a perspective view of the example combine harvester shown in FIG. 1, and further illustrating a folded configuration of the row unit divider assemblies.

DETAILED DESCRIPTION

Various embodiments will be described in detail with reference to the drawings, wherein like reference numerals represent like parts and assemblies throughout the several views. Reference to various embodiments does not limit the scope of the claims attached hereto. Additionally, any examples set forth in this specification are not intended to be limiting and merely set forth some of the many possible embodiments for the appended claims.

FIG. 1 is a perspective view of an example combine harvester **100**. In this example, the combine harvester **100** includes a combine machine **102** and header **104**. The header **104** includes multiple row unit divider assemblies **106**, including a height and tension adjustment device **130** (as shown in FIGS. 3-4).

In this example, the combine harvester **100** operates to harvest grain crops. In some embodiments, the harvester is a corn harvester, which operates to harvest corn, for example. In some embodiments, the harvester is a combine, which performs harvesting operations including reaping, threshing, and winnowing.

The combine harvester **100** includes a combine machine **102**. The harvester machine **102** is typically a self-propelled vehicle, including wheels and an engine that drives the wheels. The combine harvester **100** also typically includes a cab where an operator interacts with various controls to operate and control the harvester **100**.

The header **104** is arranged at and extends from a forward end of the harvester. As the combine harvester **100** advances forward through the crops, the header **104** operates to collect and cut crops to separate them from the ground.

The separated crops are then fed into the combine machine **102** where the corn is separated from the cob and material other than grain (M.O.G.), which is dropped from the rear of the combine machine **102**. In some embodiments, a threshing and winnowing process is used to loosen and separate the grain from the chaff that remains. The grain is then stored in a storage bin within the combine machine **102**, and can be subsequently transferred to another vehicle or storage area, as desired.

In some embodiments, the header **104** includes a plurality of row unit divider assemblies **106**. The row unit divider assemblies **106** are sized and configured to gather crops from respective rows of the crops. For example, corn is often grown along rows, which are separate from each other with a uniform row spacing. Row spacing can be from about 15 inches to about 38 inches, for example. The row unit divider assemblies **106** are spaced from each other at about the same spacing.

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When the combine harvester **100** is operating, the row unit divider assemblies **106** are positioned between the rows. As the row unit divider assemblies **106** are advanced through the crop by the combine harvester, the row unit divider assemblies **106** guide and support the plants as they enter the combine machine **102**.

FIG. 2 is a side perspective view of an example of a row unit divider assembly **106**. In this example, the row unit divider assembly **106** includes a bonnet **112** and a snout **114**. Also illustrated in FIG. 2 is a snout pivot **116**, wear point **118**, and snout body **120**.

The bonnet **112** is the rearward portion of the row unit divider assembly **106** that is fastenable to a forward end of the combine machine **102**. The bonnet **112** includes a bonnet frame (shown in FIG. 3) that provides structural support to the bonnet **112** for connection with the combine machine **102**.

The snout **114** is an elongate structure that is pivotally connected to and extends from a forward end of the bonnet **112**. The snout includes a body **120**, which is formed of a sturdy material such as metal or plastic. In some embodiments, the body **120** is formed of polyethylene, for example. In some embodiments the body is an elongate structure having a tapered shape that is larger toward the rearward end and smaller toward the forward end.

In some embodiments, the snout **114** is connected to the bonnet **112** at a snout pivot **116**. The snout pivot **116** permits the snout to pivot with respect to the bonnet **112** around the snout pivot **116**, such as in the direction **A1**, as well as in the direction opposite direction **A1**. The pivot **116** permits the height (**D1**) of the snout **114** to be adjusted with respect to the ground **G**, without adjusting the position of the bonnet **112**. The pivot **116** also permits the snout **114** to pivot when the snout (or wear point **118**) comes in contact with the ground **G** or another object, such as to reduce the chance of breaking the snout **114** or row unit divider assembly **106**. Further, the pivot **116** permits the row unit divider assemblies **106** to be placed in a folded configuration (such as shown in FIG. 5) for more compact transportation and storage.

When the snout **114** pivots about bonnet **112**, an angle between the snout **114** and the bonnet **112** changes. When the position of the bonnet **112** is held stationary, a change in the angle causes a change in the height (**D1**) of the snout with respect to the ground. Therefore, by adjusting the angle between the snout **114** and the bonnet **112**, the height (**D1**) of the snout **114** is also adjusted.

FIG. 3 is a perspective bottom view of a portion of the row unit divider assembly **106**, shown in FIG. 2. In this example, the row unit divider assembly **106** includes the bonnet **112**, snout **114**, snout pivot **116**, and height and tension adjustment device **130**. The bonnet **112** includes a bonnet frame **122**. The snout **114** includes a body **120** including a bridge **124**.

The height and tension adjustment device **130** permits easy adjustment of the height (**D1**) of the snout with respect to the ground, and the tension by which the snout **114** is pressed toward the ground.

In this example, the height and tension adjustment device **130** includes a rod having a first end **134**, a second end **136**, a bridge coupler **137**, a height adjustment device **138**, and a tension adjustment device **140**.

The rod **132** is a rigid elongate member, such as made of metal. A first end **134** of the rod **132** is configured to be connected to the bonnet frame **122**. In some embodiments, the first end **134** includes a rod end, formed of a cylindrical tube and having an aperture extending therethrough. The first end **134** is connected to the bonnet frame **122** using a pin, for example. The pin forms a pivot axis to permit the rod **132** to pivot with respect to the bonnet frame **122** when the angle

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changes between the bonnet **112** and the snout **114**. The pin also permits the height and tension adjustment device **130** to be quickly disconnected from the bonnet frame **122** by removing the pin from the first end **134**, allowing the snout **114** to freely pivot about the snout pivot **116**.

A second end **136** of the rod **132** is arranged opposite the first end **134**. In some embodiments, the rod **132** extends through a bridge of the snout **114**, and is fastened to the bridge **124** with a bridge coupler **137**.

The bridge **124** is a portion of the snout **114** to which the height and tension adjustment device **130** can be fastened. In some embodiments, the bridge **124** is a structural feature integrally molded into the snout body **120**. The snout body **120** and the bridge **124** can be formed of polyethylene, for example, or other suitable materials.

The height adjustment device **138** is arranged toward the second end **136** of the rod and operates to adjust the angle between the bonnet **112** and snout **114**, and accordingly to adjust a height of the snout **114** with respect to the ground. In the illustrated example, the height adjustment device **138** includes a height adjustment knob having threaded features that engage with a corresponding threaded feature of the rod **132**. By rotating the knob clockwise or counterclockwise, the rod **132** is advanced through bridge **124**, adjusting the distance between the first end **134** and the bridge **124**, and therefore causing the snout **114** to pivot about the snout pivot **116**.

The tension adjustment device **140** is positioned between the first end **134** and the second end **136** of the rod **132**, and between the first end **134** and the height adjustment device **138**. For example, in some embodiments the height adjustment device **138** and the tension adjustment device **140** are configured to be arranged on opposite sides of the bridge **124**.

The tension adjustment device **140** is configured to provide a downward force on the snout **114** to oppose upward movement of the snout **114**, and to provide an adjustable magnitude of the downward force. In this example, the tension adjustment device **140** includes a tension adjustment knob having threaded features that engage with corresponding threaded features on the rod **132**. Rotation of the knob clockwise and counter clockwise permits the tension to be adjusted to increase or decrease the tension supplied by the tension adjustment device **140**.

As a more specific example, the tension adjustment device **140** includes a tension adjustment knob and a spring. The tension adjustment knob is rotatable to increase or decrease the amount that the spring is compressed. The greater the compression, the greater the force that the spring applies between the tension adjustment knob and the bridge **124**. When the snout **114** moves upward (pivoting in the direction **A1**, shown in FIG. 2) the bridge moves toward the tension adjustment knob, thereby further compressing the spring. Accordingly, the spring resists this movement, and tends to keep the snout **114** down unless the snout comes into contact with an object that provides a force sufficient to overcome the force of the spring, in which case the snout **114** is permitted to rise up. Once the upward force has been removed, the snout **114** returns to the original position, as set by the height adjustment device **138**.

In some embodiments, the height and tension adjustment device **130** permits hand adjustment of the height and tension of the snout without the need for any additional tools.

In some embodiments, the height and tension adjustment device **130** permits full range of motion of the snout **114** with respect to the bonnet **112** (and the ground).

FIG. 4 is a side view of the example height and tension adjustment device **130** shown in FIG. 3. In this example, the

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height and tension adjustment device **130** includes the rod having the first end **134**, the second end **136**, bridge coupler **137**, the height adjustment device **138**, and the tension adjustment device **140**.

The rod **132** is typically an elongate cylindrical rod, which is at least partially threaded for interaction with the height adjustment device **138** and the tension adjustment device **140**.

Adjacent the first end **134** of the rod is an aperture **152**. A pin **154** is provided which is sized to be inserted within the aperture **152** and has a length suitable for pivotally coupling the first end **134** with the bonnet frame **122** (as shown in FIG. 3). To prevent loss of the pin **154**, a cord **156** is provided in some embodiments, which is connected to the pin **154** by a ring, for example. An opposite end of the cord **156** can be fastened to a part of the row unit divider assembly **106**, such as to the bonnet frame **122** (as also shown in FIG. 3).

The height adjustment device **138** is arranged toward the second end of the rod **132**. In this example, the height adjustment device **138** includes a height adjustment knob **162**. The height adjustment knob **162** includes a threaded internal bore that engages with a threaded portion of the rod **132**. The position of the height adjustment knob **162** is adjusted by a user by rotating the height adjustment knob clockwise or counter clockwise. When the height adjustment knob **162** is moved away from the first end **134**, the snout **114** pivots (in the direction opposite direction **A1**, shown in FIG. 2), which causes the snout **114** to be lowered closer to the ground (reducing distance **D1**, shown in FIG. 2). When the height adjustment knob **162** is moved toward the first end **134**, the snout **114** pivots (in the direction **A1**, shown in FIG. 2), which causes the snout **114** to be raised away from the ground (increasing distance **D1**, shown in FIG. 2.)

The height adjustment knob **162** is configured to be adjusted by a hand of an operator, without requiring additional tools. In this example, the knob **162** includes relatively large protrusions sized for easy insertion of one or more fingers therein, and the knob **162** is sized to be grasped in the hand of the operator.

The bridge coupler **137** is configured to connect the height and tension adjustment device **130** to the bridge **124** (shown in FIG. 3) of the snout **114**. In this example, the bridge coupler **137** includes plates **164** and **166**, and slide bushing **168**. When installed on the snout **114**, the slide bushing **168** is inserted within an aperture formed in the bridge **124** and functions to reduce sliding friction between the rod **132** and the bridge **124** to permit sliding movement of the rod **132** through the aperture in the bridge **124**. The plates **164** and **166** are sized larger than the bridge aperture and are configured to securely fasten the height and tension adjustment device **130** to the bridge **124**. For example, the plate **164** is positioned forward the aperture and the plate **166** is positioned rearward the aperture. Bolts or other fasteners can be used to couple the plates together through additional apertures formed through the bridge **124** and secure the plates on either side of the bridge **124**. The bridge coupler **137** secures the height and tension adjustment device **130** to the bridge **124**, while permitting the rod **132** to slide back and forth through the bridge **124**.

The tension adjustment device **140** is positioned between the first end **134** of the rod **132** and the bridge coupler **137**, and operates to provide an adjustable force between the bonnet **112** and the snout **114** to resist movement of the snout **114** in the direction **A1** shown in FIG. 2, tending to lift the snout **114** away from the ground.

In this example, the tension adjustment device **140** includes a tension adjustment knob **170** and a spring **172**.

The tension adjustment knob **170** includes a threaded bore that is configured to engage with a threaded portion of the rod

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132. Rotation of the tension adjustment knob **170** causes the knob **170** to move forward and backward along the rod **132**, thereby increasing or decreasing the compression of the spring **172**.

The spring **172** surrounds a portion of the rod **132** and is coaxial (or substantially coaxial) with the rod **132**. In this example, the spring **172** is a helical compression spring. When compressed, the spring **172** generates a force that is applied to the tension adjustment knob **170** at one end, and to the bridge (either directly or through the bridge coupler **137**) at an opposite end.

When the tension adjustment knob **170** is rotated, the amount of force required to lift the snout **114** away from the ground (to increase distance **D1**, shown in FIG. 2) is adjusted. When the knob **170** is moved toward the bridge coupler **137**, the force is increased, and when the knob **170** is moved away from the bridge coupler **137**, the force is decreased.

The tension adjustment knob **170** is configured to be adjusted by a hand of an operator, without requiring additional tools. In this example, the knob **170** includes relatively large protrusions sized for easy insertion of one or more fingers therebetween, and the knob **162** is sized to be grasped in the hand of the operator.

When the snout **114** is raised away from the ground, the snout **114** pivots about the snout pivot **116** in the direction **A1**, shown in FIG. 3. This causes the bridge **124** and bridge coupler **137** to move toward the first end **134** of rod **132**, and causes rod **132** to slide through the slide bushing **168**. Although the spring **172** provides a force to resist this movement, the spring **172** does permit the movement to occur. If the force is great enough, the movement can continue until the spring is fully compressed or the tension adjustment knob **170** comes into contact with the bridge coupling **137**. The amount of movement that is permitted can be adjusted by using a longer or a shorter rod **132**, and a correspondingly longer or shorter spring **172**.

FIG. 5 is a perspective view of the example combine harvester **100**, illustrating the header **104** and row unit divider assemblies **106** arranged in a folded configuration.

In some embodiments, the height and tension adjustment device **130** is disconnectable to permit the snout **114** to freely pivot about the snout pivot **116**. For example, the first end **134** can be disconnected from the bonnet frame **122** by removing the pin **154** (as shown in FIGS. 3-4).

Once disconnected, the bonnets **112** are rotated upward, while the snouts **114** pivot downward under the force of gravity. The folded configuration of the row unit divider assemblies **106** requires less horizontal space for transportation and storage.

The various embodiments described above are provided by way of illustration only and should not be construed to limit the claims attached hereto. Those skilled in the art will readily recognize various modifications and changes that may be made without following the example embodiments and applications illustrated and described herein, and without departing from the true spirit and scope of the following claims.

What is claimed is:

1. A row unit divider assembly for a combine harvester, the combine harvester for harvesting crops growing from a ground surface of a field, the row unit divider assembly comprising:

- a bonnet portion having a forward bonnet end and a rearward bonnet end opposite to the forward bonnet end;
- a snout portion having a forward snout end and a rearward snout end opposite to the forward snout end, the rearward snout end pivotally connected to the forward bonnet end of the bonnet portion; and

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a height and tension adjustment device coupled between the bonnet portion and the snout portion and arranged proximate to the forward bonnet end and to the rearward snout end, the height and tension adjustment device including:

- a height adjustment device operable to adjust an angle of the snout portion with respect to the bonnet portion; and
- a tension adjustment device including a spring to apply a tension to the snout portion, by which the snout portion is pressed toward the ground surface to resist upward movement of the snout portion away from the ground surface, the tension adjustment device operable to adjust the tension applied to the snout portion.

2. The row unit divider assembly of claim 1, wherein: the snout portion includes a bridge to which the height and tension adjustment device is engaged; the height and tension adjustment device includes a rod having a first end and a second end, the first end connected to the bonnet portion to allow the rod to pivot relative to the bonnet portion, and the second end secured to the bridge of the snout portion; the height adjustment device is arranged at the second end of the rod and configured to adjust a distance between the first end of the rod and the bridge of the snout portion; and the tension adjustment device is configured to provide an adjustable downward force on the snout portion to oppose upward movement of the snout portion away from the ground.

3. The row unit divider assembly of claim 2, wherein: the height and tension adjustment device includes a pin; and the rod defines an aperture at the first end, the aperture through which the pin is inserted to pivotally couple the first end of the rod to the bonnet portion.

4. The row unit divider assembly of claim 2, wherein: the height adjustment device includes a height adjustment knob threadedly engaging the rod, the height adjustment knob configured to be rotated to adjust a position of the height adjustment knob relative to the rod.

5. The row unit divider assembly of claim 2, wherein: the tension adjustment device is positioned between the first end of the rod and the height adjustment device and including a tension adjustment knob, the tension adjustment knob threadedly engaging the rod, the tension adjustment knob configured to be rotated to adjust the tension generated by the tension adjustment device.

6. The row unit divider assembly of claim 5, wherein: the spring of the tension adjustment device surrounds at least a portion of the rod, the spring disposed between the tension adjustment knob and the bridge of the snout portion and generating a force applied to the tension adjustment knob and the bridge in opposite directions; and the tension adjustment knob rotatable to adjust an amount that the spring is compressed between the tension adjustment knob and the bridge.

7. A combine harvester for harvesting crops growing from a ground surface of a field, the combine harvester comprising: a combine machine; and a header including a plurality of row unit divider assemblies for a combine harvester, each row unit divider assembly comprising: a bonnet portion having a forward bonnet end and a rearward bonnet end opposite to the forward bonnet end;

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a snout portion having a forward snout end and a rearward snout end opposite to the forward end, the rearward snout end pivotally connected to the forward bonnet end of the bonnet portion; and

a height and tension adjustment device coupled between the bonnet portion and the snout portion and arranged proximate to the forward bonnet end and to the rearward snout end, the height and tension adjustment device including:

- a height adjustment device operable to adjust an angle of the snout portion with respect to the bonnet portion; and
- a tension adjustment device including a spring to apply a tension to the snout portion, by which the snout portion is pressed toward the ground surface to resist upward movement of the snout portion away from the ground surface, the tension adjustment device operable to adjust the tension applied to the snout portion.

8. The combine harvester of claim 7, wherein: the snout portion includes a bridge to which the height and tension adjustment device is engaged; the height and tension adjustment device includes a rod having a first end and a second end, the first end connected to the bonnet portion to allow the rod to pivot relative to the bonnet portion, and the second end secured to the bridge of the snout portion; the height adjustment device is arranged at the second end of the rod and configured to adjust a distance between the first end of the rod and the bridge of the snout portion; and the tension adjustment device is configured to provide an adjustable downward force on the snout portion to oppose upward movement of the snout portion away from the ground.

9. The combine harvester of claim 8, wherein: the height and tension adjustment device includes a pin; and the rod defines an aperture at the first end, the aperture through which the pin is inserted to pivotally couple the first end of the rod to the bonnet portion.

10. The combine harvester of claim 8, wherein: the height adjustment device includes a height adjustment knob threadedly engaging the rod, the height adjustment knob configured to be rotated to adjust a position of the height adjustment knob relative to the rod.

11. The combine harvester of claim 8, wherein: the tension adjustment device is positioned between the first end of the rod and the height adjustment device and including a tension adjustment knob, the tension adjustment knob threadedly engaging the rod, the tension adjustment knob configured to be rotated to adjust the tension generated by the tension adjustment device.

12. The combine harvester of claim 11, wherein: the spring of the tension adjustment device surrounds at least a portion of the rod, the spring disposed between the tension adjustment knob and the bridge of the snout portion and generating a force applied to the tension adjustment knob and the bridge in opposite directions; and the tension adjustment knob rotatable to adjust an amount that the spring is compressed between the tension adjustment knob and the bridge.

13. A height and tension adjustment device configured for installation between a bonnet portion of a row unit divider assembly and a snout portion of the row unit divider assembly, the height and tension adjustment device comprising:

- a rod including a first end and a second end, wherein the first end is configured to be coupled to the bonnet portion of the row unit divider assembly;
- a height adjustment knob positioned toward the second end of the rod and being adjustable along the length of the rod to adjust an angle of the snout portion with respect to the bonnet portion;
- a tension adjustment knob positioned between the first end of the rod and the height adjustment knob, the tension adjustment knob adjustable along the length of the rod to adjust a tension applied to the snout portion; and
- a spring surrounding the rod and disposed between the height adjustment knob and the tension adjustment knob, the spring configured to apply the tension to the snout portion, by which the snout portion is pressed toward the ground surface to resist upward movement of the snout portion away from a ground surface.

14. A method of adjusting a snout of a row unit divider assembly for a combine harvester, the method comprising:

- installing a height and tension adjustment device between a bonnet and snout of the row unit divider assembly, the bonnet and snout pivotally coupled at a snout pivot, and the height and tension adjustment device arranged proximate to the snout pivot;
- adjusting a height of the snout with respect to the ground by adjusting a height adjustment knob of the height and tension adjustment assembly; and
- adjusting a downward force applied to the snout by adjusting a tension adjustment knob of the height and tension adjustment assembly, the height and tension adjustment assembly including a spring configured to generate the downward force, by which the snout is pressed down toward the ground to resist upward movement of the snout with respect to the bonnet after adjusting the height and downward force, while permitting upward movement if the upward movement has a sufficient force that exceeds the downward force.

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